UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

APPLICANT(S)	Vahid Goudarzi	CONFIRMATION NO.:	1459
APPLN. NO.:	10/678,489	EXAMINER:	Vu, David
FILED:	October 3, 2003	GROUP ART UNIT:	2818
DOCKET NO.	CE11821JME		
TITLE:	METHOD AND ARRANGEMENT FOR REDUCED THERMAL STRESS BETWEEN SUBSTRATES		

CERTIFICATE UNDER 37 CFR 1.8(a)	
I hereby certify that this correspondence is being electronically transmitted on the date listed below:	
Date:	March 14, 2007
Signature	/Larry G. Brown/
Typed or printed name:	Larry G. Brown

TRANSMITTAL LETTER FOR BRIEF ON APPEAL

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P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Enclosed please find one copy of an Appeal Brief filed on behalf of the applicants in the matter of the above entitled application. This Brief is filed pursuant to 37 CFR § 41.37 in furtherance of the Notice of Appeal filed on February 5, 2007.

The Commissioner is authorized to charge any requisite fees for filing the enclosed Brief to Motorola, Inc., Deposit Account No. 502117. Any overpayment should be credit to the same Deposit Account.

Respectfully submitted,

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APPEAL BRIEF

Mail Stop: **APPEAL BRIEF-PATENTS**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attention: Board of Patent Appeals and Interferences

Dear Chief Administrative Patent Judge:

This Appeal Brief is in response to the Notice of Panel Decision from Pre-Appeal Brief Review of March 2, 2007 and is in furtherance of Applicants' Notice of Appeal filed on February 5, 2007. The fees required under 37 C.F.R. § 41.20(b)(2) for filing this Appeal Brief have been authorized.

I. REAL PARTY IN INTEREST

The real party of interest is Motorola, Inc., a Delaware corporation.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

This is an appeal from the final rejection of claims 7-20 of the above-referenced application.

A. TOTAL NUMBER OF CLAIMS IN APPLICATION

There are a total of 14 claims in the application.

B. STATUS OF ALL THE CLAIMS

1. Claims allowed: none
2. Claims objected to: none
3. Claims rejected: 7-20

C. CLAIMS ON APPEAL

The claims on appeal are 7-20.

IV. STATUS OF AMENDMENTS

No amendments have been filed subsequent to the Final Rejection.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Although specification citations are inserted below in accordance with C.F.R. 41.37, these reference numerals and citations are merely examples of where support may be found in the specification for the terms used in this section of the brief. There is no intention to in any way suggest that the terms of the claims are limited to the examples in the specification. Although, as demonstrated by the reference numerals and citations below, the claims are fully supported by the specification as required by law, it is improper under the law to read limitations from the specification into the claims. Pointing out specification support for the claim terminology, as is done here to comply with rule 41.37, does not in any way limit the scope of the claims to those examples from which they find support. Nor does this exercise provide a mechanism for circumventing the law precluding reading limitations into the claims from the specification. In short, the reference numerals and specification citations are not to be construed as claim limitations or in any way used to limit the scope of the claims.

The claimed subject matter of independent claim 1 pertains to a module (20) that includes a first substrate (12) made of a first material and at least a second substrate (22) made of at least a second material (see FIGs. 2 and 3 and paragraph 0014 on page 4 of the specification). The module (20) may also include solder (14) of a first composition residing between the first substrate (12) and at least the second substrate (22) on at least a first area (18) (see FIG. 1 and paragraph 0015 on page 4 of the specification). Moreover, the module (20) can have solder (16) of at least a second composition residing between the first substrate (12) and at least the second substrate (22) on at least a separate area from the first area (18) such that the solder (14) of the first composition and the solder (16) of the second composition are vertically separated (see FIGs. 2 and 3 and paragraph 0015, pages 4-5 of the specification; page 3 of Applicants' Amendment of May 30, 2006; and FIG. 5, also submitted with the Amendment of May 30, 2006). Both the solder (14) of the first composition and the solder of the second composition (16) are in a collapsed state (see page 3 of Applicants' Amendment of May 30, 2006 and FIG. 5, also submitted with the Amendment of May 30, 2006).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 7, 8, 15-17 and 20 are patentable under 35 U.S.C. 102(b) over U.S. Patent No. 5,346,118 to Degani (Degani).

Whether claims 7-10, 12 and 14-20 are patentable under 35 U.S.C. 102(b) over U.S. Patent No. 6,150,717 to Wood, et al. (Wood).

Whether claims 7-10, 12 and 14-20 are patentable under 35 U.S.C. 102(b) over U.S. Patent No. 5,539,153 to Schwiebert, et al. (Schwiebert).

Whether claims 11 and 13 are patentable under 35 U.S.C. 103(a) over Schwiebert in view of Degani.

VII. ARGUMENT

A. The recitations of Degani do not render the invention of claims 7, 8, 15-17 and 20 unpatentable.

Degani discloses a process for soldering a component having solder bumps to a substrate (see Abstract). In particular, in FIG. 4, Degani shows an assembly with solder bumps (12) on an IC package (10) and solder bumps (17) formed on a board (11). A similar construction is shown in FIG. 5 in which solder paste deposits (18) are formed over terminal pads (14) on the board (11). Degani does not describe the placement of solder of different compositions in different areas between the IC package (10) and the board (11) or solders of two different compositions being in a collapsed state. In addition, the process described in Degani addresses the issue of establishing a reliable solder joint while at the same time avoiding shorts between adjacent solder joints (see col. 2, lines 3-9). Degani never discusses the issue of different coefficients of thermal expansion (CTE) between various substrates.

In attempting to describe how Degani reads on the present invention, the Examiner has referred to the solder bumps (12) of Degani as solder of both a first and second composition (see paragraph 2 of the Office Action of August 3, 2006). Such an interpretation of Degani is simply incorrect. In particular, one of ordinary skill in the art would appreciate that by reciting the terms “first” and “second” when referring to “composition” in claim 7, the claimed invention makes use of different solder compositions between the substrates. The specification clearly explains this feature (see paragraph 0013) and to hold that a first composition and a second composition are identical goes against the clear understanding of these words. In fact, the Examiner appears to implicitly agree with this interpretation, as the Examiner refers to a first material of the Wood reference - DDC/PCB - and a second material of the Wood reference - ceramic (see paragraph 3 of the Office Action of August 3, 2006). That is, the Examiner has taken a course here in which the interpretation of the modifiers “first” and “second” is limited to differentiation.

It is also important to note that Degani recites suitable examples of the compositions of solder alloys (see col. 6, line 15 to col. 7, line 3). Thus, at the time of the invention, the inventors of Degani were clearly aware of several solder compositions. Even so, however, there is no evidence that Degani contemplates the use of solder of first and second compositions in separate areas such that the compositions are vertically separated.

Also, Degani does not disclose, teach, illustrate or suggest the concept of having both the solder of the first composition and the solder of the second composition in a collapsed state. In contrast with Degani, the different solders of the claimed subject matter are in a collapsed state in the final assembly. Because they were allowed to liquefy during the reflow process, the final assembly that includes the collapsed solders will be lower in height than in Degani, which is important in view of certain electronic devices becoming smaller and smaller. In addition, the collapsed solder results in a final assembly that has a higher structural integrity than that in these prior art references.

In paragraph 8 of the Office Action of August 3, 2006, the Examiner argues that “. . . the process of reflowing the solder of the first composition and the second composition does not structurally distinguish the claimed invention over Degani, Wood and Schwiebert.” Applicants submit that claim 7 does not attempt to ensnare within its scope the process of reflowing solder. The claim specifically recites that the solder of the first and second compositions is in a collapsed state.

The noun “state,” as one of skill in the art would appreciate, refers to the condition of the first and second compositions. One of skill in the art would also understand that the adjective “collapsed” further describes the condition of these compositions as having lost their structural integrity. Thus, claim 7 does not attempt to claim the actual process of reflowing solder; rather, claim 7 contains a limitation that describes the *structure* of the compositions once the reflow process has been completed.

B. The recitations of Wood do not render the invention of claims 7-10, 12 and 14-20 unpatentable.

(1) Claims 7-10, 12, 14-17 and 20

Wood is directed to a semiconductor package and a method for fabricating the package (see Abstract). As shown in FIGs. 11-11E, bumped electrodes (96) and solder bumps (12M) can be formed of various alloys. In particular, the solder bumps (12M) are formed of a high-temperature solder alloy, and the bumped electrodes (96) are comprised of a low-temperature solder alloy (see col. 9, lines 8-14). The temperature of a reflow process is maintained at a temperature *between* the different melting temperatures of these solder alloys (see col. 10, lines 1-3). As a result, the bumped electrodes (96) liquefy and form a bonded connection with the solder bumps (12M) (see col. 10, lines 7-8). The solder bumps (12M), however, maintain their structural rigidity during the reflow process, which prevents collapse of the die (10M) onto the supporting substrate (see col. 10, lines 4-6). Moreover, Wood does not describe the placement of solder of different compositions in different areas between the die (10M) and the supporting substrate such that the different compositions are vertically separated. Wood also does not address the issue of mismatching CTEs; the process described above is only concerned with preventing a component from collapsing onto a board.

The argument above in Section A also applies to the Examiner's reading of the Wood reference. Specifically, the Examiner refers to the solder bumps (12) and bumped electrodes (96) of Wood as both solder of a first composition and solder of a second composition (see paragraph 3 of the Office Action of August 3, 2006). Although the solder bumps (12) and the bumped electrodes (96) are comprised of different solder alloys (see col. 9, lines 8-11), the composition of the union of these two solder alloys is the same throughout the module (see FIGs. 11A-11C). That is, the bonded connections that are formed in Wood are similar in composition (though consisting of different alloys) over the entire area of the module; bonded connections of compositions that are different from and in areas separate from the uniform bonded connections shown in FIGs. 11A-11C and are not described in Wood. Similar to Degani, Wood also recites suitable examples of the compositions of solder alloys (see col. 6, lines 32 – 36 and col. 9, lines 11-14), although there is simply no indication in Wood that Wood contemplates the use of solder of first and second compositions in separate areas such that the compositions are vertically separated.

Also, Wood does not disclose, teach, illustrate or suggest the concept of having both the solder of the first composition and the solder of the second composition in a collapsed state. At best, Wood shows bumped electrodes in a collapsed state (see FIG. 11C), but the “solder bumps (12M) have a structural rigidity that prevents collapse of the die (10M) onto the supporting substrate.” (see col. 10, lines 4-6).

(2) Claims 18 and 19

In reference to claims 18 and 19, Wood does not disclose, teach, illustrate or suggest the concept of solder of a first composition, which is in a substantially centrally-located area of the first substrate or the second substrate, having a higher melting point than solder of a second composition, which is in a substantially peripherally-located area about the centrally-located area. In particular, the passage in Wood to which the Examiner refers (col. 9, lines 7-22) in rejecting these claims in paragraph 3 of the Office Action of August 3, 2006 simply does not mention anything about placing solder of different compositions in such areas. The presently claimed concept allows for a more structurally sound assembly.

C. The recitations of Schwiebert do not render the invention of claims 7-10, 12 and 14-20 unpatentable.

(1) Claims 7-10, 12, 14-17 and 20

Schwiebert discloses a method of bumping substrates by contained paste deposition. As depicted in FIGs. 6A-6C, stand-off bumps (610) and metal bumps for interconnection (612) are formed on a substrate. The stand-off bumps (610) are made of a material that has a higher melting point than the metal bumps (612) (see col. 11, lines 46-47). As such, during reflow, the stand-off bumps (610) will not melt and collapse, i.e., they will maintain their structural rigidity, and the metal bumps for interconnection (612) will liquefy. The final product is shown in FIG. 6C. Here, the stand-off bumps (610) are provided merely to set and control the height between two substrates (see col. 11, lines 41-42). Further, the metal bumps (612), which have a lower melting point than that of the stand-off bumps (610), are placed in the center of the substrate, and the stand-off bumps (610) are positioned at the periphery of the substrate (see FIGs. 6B and 6C).

Schwiebert does not disclose, teach, illustrate or suggest the concept of having both the solder of the first composition and the solder of the second composition in a collapsed state. In particular, one of the solders in Schwiebert is a stand-off bump, which maintains its structural integrity throughout the reflow process and does not collapse. As a result, the stand-off bumps that reside between the two substrates are not in a collapsed state (see FIG. 6C).

(2) Claims 18 and 19

In reference to claims 18 and 19, Schwiebert does not disclose, teach, illustrate or suggest the concept of solder of a first composition, which is in a substantially centrally-located area of the first substrate or the second substrate, having a higher melting point than solder of a second composition, which is in a substantially peripherally-located area about the centrally-located area. In fact, Schwiebert teaches the exact opposite, as it calls for the stand-off bumps 610, which are made of a material that does not melt at the desired processing temperature (see col. 11, lines 46-47), to be positioned on the periphery of the substrate (see FIGs. 6A-6C).

D. *The recitations of Schwiebert and Degani do not render the invention of claims 11 and 13 unpatentable.*

For the reasons set forth in sections A and C(1), the proposed combination of the Schwiebert and Degani references does not read on claims 11 and 13.

Conclusion

Because every element of the claimed subject matter is not disclosed by the cited prior art references, either individually or in combination with one another, Applicants submit that the claims on appeal are patentable.

For the reasons set forth above, and as is apparent from a review of the above-cited references, the claims on appeal present patentable subject matter such that reversal of the rejection is appropriate.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

Claims 1-6 (cancelled)

7. (previously presented) A module, comprising:

a first substrate comprised of a first material;

at least a second substrate comprised of at least a second material;

solder of a first composition residing between the first substrate and at least the second substrate on at least a first area; and

solder of at least a second composition residing between the first substrate and at least the second substrate on at least a separate area from the first area such that the solder of the first composition and the solder of the second composition are vertically separated;

wherein both the solder of the first composition and the solder of the second composition are in a collapsed state.

8. (previously presented) The module of claim 7, wherein the first substrate has a first coefficient of thermal expansion and the second composition has a second coefficient of thermal expansion.

9. (previously presented) The module of claim 7, wherein the first substrate is comprised of a printed circuit board material having a coefficient of thermal expansion and the second substrate is a ceramic material having a different coefficient of thermal expansion.

10. (previously presented) The module of claim 7, wherein the solder of the first composition has a higher melting point solder than the solder of the second composition.

11. (original) The module of claim 10, wherein the higher melting point solder is comprised of approximately 95.5%Sn, 3.8%Ag and 0.7%Cu.

12. (previously presented) The module of claim 10, wherein the solder of the first composition is on input/output solder pads.

13. (original) The module of claim 10, wherein the solder of the second composition is comprised of approximately 57%Bi, 42%Sn, and 1%Ag.

14. (previously presented) The module of claim 10, wherein the solder of at least the second composition is on ground pads.

15. (original) The module of claim 7 wherein the module is a ball grid array package.

16. (previously presented) The module of claim 7, wherein the solder of the first composition and the solder of at least the second composition are comprised of solder balls.

17. (previously presented) The module of claim 7, wherein the solder of the first composition and the solder of at least the second composition are comprised of solder paste.

18. (previously presented) The module of claim 16, wherein the solder of the first composition is in a substantially centrally located area on at least one among the first substrate and the second substrate and the solder of at least the second composition is in a substantially peripherally located area about the centrally located area, wherein the solder of the first composition has a higher melting point than the solder of the second composition.

19. (previously presented) The module of claim 7, wherein the solder of the first composition is in a substantially centrally located area on at least one among the first substrate and the second substrate and the solder of at least the second composition is in a substantially peripherally located area about the centrally located area, wherein the solder of the first composition has a higher melting point than the solder of the second composition.

20. (previously presented) The module of claim 7, wherein at least one among the first substrate and the second substrate further comprises a plurality of solder pads and the solder of the first composition is on a different set of solder pads among the plurality of solder pads than the solder of the second composition.

IX. EVIDENCE APPENDIX

None

X. RELATED PROCEEDINGS APPENDIX

None